

ON SIPHONAPTERA COLLECTED IN ALGERIA.

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(Plates VI.—XII.).

DURING the spring of the present year (1912) the Hon. L. W. Rothschild and the senior author of this paper again paid a visit to Algeria, chiefly with a view to collecting Lepidoptera. As the British Museum had hardly any small mammals from the coast district and the Central Plateaux, and as, moreover, very little was known of the Siphonaptera of Algeria, some time was devoted during the visit to collecting mammalia and their ectoparasites, with the result that 160-odd skins belonging to 16 species were brought home, as well as a fairly large number of fleas and other parasites.

The collections were made in four localities—Alger, Hammam Rirha, Guelt-es-Stel, and Khenchela—the first two places being situated in Northern Algeria and the other two on the Central Plateaux. The strong physiographical contrast which exists on the one hand between the northern district of Algeria (i.e. the coast inclusive of the northern mountain ranges) and on the other the high plains which are the centre of the country, and extend from west to east, has produced, as is well known, also most striking contrasts in the fauna and flora. The coast district is characterised by a good supply of water, luxuriant vegetation, cornfields and vineyards, the mountains being clad with forest. The mammals and fleas obtained at Alger and Hammam Rirha are identical, and from the look of the country we presume that the same species extend southward to the northern borders of the central plains as far as the same conditions of life prevail—to the neighbourhood of Boghari, for instance. The traps intended for shrews and rodents (to be caught alive) were placed under the rank vegetation at the edges of fields and meadows and in the hedges. The neighbourhood of Alger being much frequented, it was not always easy to find places where the traps were safe from interference. As the traps, however, can be entirely covered up, and as also the butterfly net distracted the attention of the Arabs who might happen to be looking on from a distance, few traps were stolen. The chief hunting grounds near Alger were the large garden of Mrs. Beresford,* opposite Hôtel Alexandra, the valley of the Femme Sauvage, and the fields between Birmandreis and the Château Hydra. The best places at Hammam Rirha were the roadsides and fields at the back of the Grand Hotel. The number of species collected is very small. The absence of the mole and all *Arvicolidæ* from Algeria is interesting, as these mammals are not particularly rare in South Portugal. The various mammals were kindly named for us by Mr. Oldfield Thomas, F.R.S.

I. ALGER AND HAMMAM RIRHA.

1. *Crocidura russula* is quite common in places which are kept damp by the rank vegetation. I obtained more specimens of this shrew than of any other

* We express our thanks also in this place to Mrs. Beresford for the very kind permission to trap in her garden, where the following species were obtained: *Crocidura russula*, *Arvicornis barbarus*, *Mus algirus*, *Mus alexandrinus*, and *Apodemus sylvaticus*.

mammal, with the exception of *Mus algirus*. It was the only species found close to the edge of the brook called La Femme Sauvage. Shrews go into a trap of our construction whether it is baited or not. They run into the dark cavity and, being of a worrying nature, try to get out at the closed end, and thus accidentally spring the trap. At Hammam Rirha the species is most frequent under the rank vegetation of the roadsides at the back of the hotel garden. No *Sorex* was met with.—K. J.

2. *Mus alexandrinus*.—A half-grown specimen was trapped in Mrs. Beresford's garden and another under a hedge near the Palace Hotel. According to the manager of the Grand Hotel at Hammam Rirha, rats are plentiful in the cellars of the hotel.—K. J.

3. *Mus musculus*.—The few specimens trapped in a house at Mustapha Supérieur did not differ in colouring from ordinary European examples, and their smell was just as bad. No fleas were found on them. At Hammam Rirha a few *musculus* were obtained in the fields at a considerable distance from the nearest house. These specimens also were at once recognised by their smell when the trap was inspected.—K. J.

4. *Mus algirus*.—This is the field mouse in Northern Algeria, and by far the commonest of all the rodents in that district, though it is less in evidence than *A. barbarus* on account of its small size. It is found in the gardens and everywhere at the roadsides, the edges of fields, and along walls constructed of rough stones. Although it resembles in general appearance *Mus musculus*, it is at once distinguished by the absence of the nauseous smell characterising *M. musculus* and by the much shorter tail.—K. J.

5. *Apodemus sylvaticus* is likewise common in the gardens and fields, frequenting the same places as *M. algirus*.—K. J.

6. *Arvicanthus barbarus*.—This was the first time that I met with the Barbary rat at large. This pretty striped rodent occurred in the gardens and in much larger numbers in the fields near Alger as well as at Hammam Rirha, and is restricted to the northern district of the country. The natives on the High Plateaux did not know it—a sure sign that this conspicuous rodent does not occur there. It appears to be partial to corn-fields, at the edges of which most of our *barbarus* were obtained.

At Hammam Rirha I also found the nest of the Barbary rat at a spot where I had trapped a female which was in milk. When going by the place the next day I heard a rather loud chirping in the barley-field. I followed the sound, expecting to find a nest with young hungry birds, and was rather surprised to see, after some minutes' search, a small blind *A. barbarus* at my feet, and a short distance away a second, both crying incessantly. The nest was close by. It consisted of dry grass, and was made in a slight depression of the ground, being dome-shaped with a side-entrance, but altogether very loose and irregular in structure, looking more like a handful of short hay than a properly made nest. There were apparently only these two babies. Several females when opened were found to contain from four to six embryos. The Barbary rat is said to be quite common in the summer. Apart from the trapped specimens I only once saw it at large, and that in day-time. I had apparently disturbed it when feeding, and it ran along a field-path much as a rat runs, not jumping like *Apodemus sylvaticus*.

The skin of *A. barbarus* is thick, but also very tender, particularly on the head, and it is not advisable to kill the specimens by throwing them on to the ground or knocking them against a hard surface, as one can safely do with *M. algirus* and

A. sylvaticus. When skinning a specimen, pulling and pressing must be avoided. The hair is smoother in young specimens than in older ones, and their striping therefore more regular.—K. J.

7. *Dipodillus campestris*.—At Alger I only caught two specimens, both adult, in the fields between Château Hydra and Sidi-Yaya, and saw a third in day-time cross a main road, jumping like *Apodemus sylvaticus*. I did not meet with the species at Hammam Rirha, where, however, our short stay was marred by bad weather, and trapping only done to a limited extent.—K. J.

II. GUELT-ES-STEL.

This place is situated between Boghari and Djelfa, in the centre of the High Plateau. As the time was limited the natives were asked to bring in mammals alive, and thus we received quite a number of specimens. But, as is generally the case under such circumstances, the result in Siphonaptera was not proportionate. If a mammal is caught by hand, or handled a good deal, the fleas leave it, as we have noticed ourselves at home with mice and moles treated in that way. However, some nests of mammals were also brought in with the young, and these gave better results. We examined about two dozen live *Elephantinus rozeti*, which is fairly frequent among the rocks, but did not find a single flea on them. The commonest mammal on the High Plateau is undoubtedly *Meriones shawi*, whose burrows are found everywhere under the *Zizyphus* bushes. I put out a number of traps in places where *Crocidura* might possibly occur, but did not find a single specimen. The range of hills in which Guelt-es-Stel lies offers many localities physiographically different, and may well be worth exploring for a collector of mammals.

III. KHENCHELA.

The town of Khenchela is situated at the eastern extremity of the Aurès Mountains in East Algeria. It is the terminus of the railway crossing the plain of the Haracta tribe from Ain-Beïda southward. We did not collect many mammals, as our time was fully occupied with the Lepidoptera, which were very abundant. Besides *Jaculus orientalis* and the inevitable *Meriones shawi* which the natives brought in, I trapped the following:

1. *Crocidura russula*. In the valley east of the town there is a plentiful supply of water—a deep brook running north, which contains a good amount of clear water even in the height of the dry season, and turns into a river during the rainy season. In the luxuriant vegetation of this valley *russula* appeared to be fairly abundant.—K. J.

2. *Mus algirus* was obtained in the same valley in small numbers.—K. J.

3. *Mus musculus* was apparently common in the town, and we also trapped it some distance away in an old *Meriones* burrow, and among the ruins of a small house.—K. J.

4. *Dipodillus campestris*, in a paler form than the one collected at Alger, was found in traps set under rocks and thorn-bushes, and a pregnant female was obtained in a trap put into a fresh burrow made under a tuft of halfa grass. A young specimen was observed late at night when I returned from moth-collecting. It jumped like an *Apodemus sylvaticus*, for which I mistook it; but when I had

knocked it over with my cap the more hairy tail at once proved it to be a *Dipodillus*.

Four of the seventeen species of mammals which we collected in Algeria did not yield any fleas—namely, two species of bats (out of three), the Hedgehog, and the Elephant-shrew. On the other thirteen species we found thirteen different kinds of fleas, of which five are new species and one a new subspecies. We did not obtain *Pulex irritans*, *Ctenocephalus canis* and *felis*, and *Ceratophyllus gallinae*, nor *Leptopsylla musculi* and *Ceratophyllus fasciatus*, which all undoubtedly occur in the coast district, if not farther inland. We found only a single species of bird-flea, which is a new subspecies, although we examined a number of nests of various kinds. What surprised us most was the absence of fleas in the sparrows' nests which we took from under the roof of the Bordj at Guelts-es-Stel, some of them being large nests which had apparently been used for years, and which in England would have been full of *fringillae* or *gallinae*. For the purpose of collecting mammals and fleas in Algeria (or elsewhere) the summer would be a more suitable time than the spring, as then both the mammals and their parasites are more plentiful, and the fleas in birds' nests have had time to breed and accumulate. At Khenchela we had sparrows' nests taken down from poplar trees, these nests also proving empty of parasites.

Although fourteen different kinds of Siphonaptera* is a very small number for such a large and varied country as Algeria, and certainly represent much less than half the species which occur there, the collection is of some general interest as regards the distribution of the Siphonaptera.

The most striking fact which can be gathered from looking over the list of captures is the entire absence of those species on the Hauts Plateaux which we found at Alger and Hammam Rirha, and vice versa. However, further search on *Dipodillus campestris*, which we may assume has a flea of its own, may possibly lead to the discovery of a species living on the dark coast race as well as on the lighter-coloured races of the High Plateaux, and the martins' nests may harbour the same species in the Northern districts as on the central plains, and the same may be the case with other mammals, and especially birds.

A further point worthy of being mentioned is the absence of the genus *Xenopsylla* from the coast districts, while this tropical and subtropical genus is abundant on the High Plateaux, and, as we know from other sources, also in the Sahara. The now almost cosmopolitan *X. cheopis* occurs, at least occasionally, on rats in the coast districts (cf. foot-note below).

The rest of the collection is a curious mixture of forms with either Palearctic or Tropical affinities. While, however, four of the species are also found in Europe, none are identical with tropical forms, apart from *Xenopsylla*. *Ceratophyllus laverani*, found on the Hauts Plateaux, *Typhloceras poppei* at Alger, and *Stenoponia tripectinata* as well as *Ischnopsylla unipunctinata* from the Hauts Plateaux, occur likewise in Europe, while three other species or subspecies are nearest to European forms, and four nearest to species from Egypt or Tropical Africa. On the whole, the Tropical affinities are predominant in contradistinction to other groups of

* To this number a few other species must be added which were collected by the Hon. L. W. Rothschild and Dr. E. Hartert on former visits to Algeria in the neighbourhood of Biskra—namely, *Pariodontia riggenbachii* Roths. (1904), *Archaeopsylla erinacei maura* Jord. & Roths. (1911), and *Ctenopsylla mira* Roths. (1909). Moreover, Billet records *cheopis*, *musculi*, *fasciatus* and *canis* from rats taken at Alger, Philippeville, Bone and Constantine (*Bull. Soc. Path. Exot.* 1. 2. (1908) p. 111).

insects, and it strikes us as particularly interesting that the new *Ctenophthalmus* and the new *Leptopsylla*, both occurring at Alger and Hammam Rirha, are closely allied to species from Tropical Africa.

1. *Xenopsylla cleopatrae* Roths. (1903).

Pulex cleopatrae Rothschild, *Ent. Mo. Mag.* (2) xiv. p. 84. no. 3. tab. 1. fig. 7, 8. tab. 2. fig. 13, 17 (1903) (Shendi, Sudan).

4 ♂♂, 4 ♀♀ from Guellet-es-Stel, off *Meriones shawi*, April 22 and 23, 1912.

1 ♀ from Guellet-es-Stel, off *Ictonyx libyca*, April 24, 1912.

2. *Xenopsylla chersinus* Roths. (1906).

Pulex chersinus Rothschild, *Entom.* xxxix. p. 75. tab. 4. fig. 1-3 (1906) (Khartum).

1 ♂ from Guellet-es-Stel, in a nest of *Dipus orientalis*, April 22, 1912.

1 ♂, 1 ♀ from Guellet-es-Stel, off *Meriones shawi*, April 23 and 24, 1912.

5 ♀♀ from Biskra, off *Dipus* spec., March 1908, collected by J. Steinbach.

The species was described from a single ♂, and the present two ♀♀ are the only examples which have come to hand since. They are distinguished from *X. nubicus* particularly by the bristles of the outer process of the clasper being all situated at or near the apex. One of the two Algerian ♂♂ differs from the other as well as from the type-specimen in the smaller number of subapical bristles on this process.

The ♀♀ are so close to those of *X. nubicus* and *X. astia* that we cannot at present distinguish them with absolute certainty. The receptaculum has the same shape in the three species. The bristles of the hind-tarsi are rather longer in *chersinus* than in the other two species.

3. *Xenopsylla ramesis* Roths. (1904).

Pulex ramesis Rothschild, *Entom.* xxxvii. p. 2. no. 2. tab. 1. fig. 3 (1904) (Lower Egypt).

3 ♂♂, 3 ♀♀ from Guellet-es-Stel, off *Meriones shawi*, April 21 and 22, 1912.

4 ♂♂, 2 ♀♀ from Khenchela, off *Meriones shawi*, May 7 and 10, 1912.

4. *Ceratophyllus barbarus* spec. nov. (Pl. VI. figs. 1 and 2).

♂♀. Both sexes are very close to *C. fasciatus* Bosc. (1801), differing only in the modified abdominal segments. Although the differences are not very striking, they appear to be constant, inasmuch as they are present in all the specimens of our long series of *barbarus*.

The finger of *barbarus* (Pl. VI. fig. 1, F) is one-sixth shorter than in true *fasciatus*, and the two large bristles placed at its distal margin have a distinctly more ventral position in *barbarus*, the lower one placed exactly in the middle of the finger or a trifle below it in *barbarus* and above the centre in *fasciatus*, the distances being measured in straight lines from the socket of the lower long bristle of the clasper to the median bristle, and from there to the

tip of the finger. The process of the clasper (Pl. VI, fig. 1, P) is more rounded than in *fasciatus*, and its distal angle less sharp.

The seventh abdominal sternite of the female of *barbarus* varies to some extent, as illustrated by Pl. VI, fig. 2. As a rule, the apical margin of this segment is distinctly notched below the upper angle, this angle being sometimes produced into an obtuse lobe; but in some specimens the notch is almost entirely effaced, the apical edge of the sternite being feebly bi-emarginate with the rounded upper angle slightly projecting. In *fasciatus* the seventh sternite is never notched and its upper angle never projects. The small bristles situated above the stigma of the eighth tergite are more numerous in *fasciatus* than in *barbarus*.

The slightness of the distinctions between *fasciatus* and *barbarus* suggests that the two forms originally were geographical varieties of one species—i.e. that *barbarus* was the North African race and *fasciatus* a European race of one single species.

C. fasciatus, apart from the specimens obtained from rats, appears to us to be geographically variable in Europe to some extent, as we hope to show in another place.

C. alladinis Roths. (1904), from tropical India, is another form very closely allied to *fasciatus*.

A large series of *C. barbarus* were obtained at Alger and Hamnam Rirha on *Arvicanthis barbarus*, and also a small number of specimens at the same places on *Apodemus sylvaticus* and *Mus algirus*, but not one specimen on *Crocidura russula*.

5. *Ceratophyllus laverani* Roths. (1911) (Pl. VIII, fig. 6).

C. L. Rothschild, Ann. Sci. Nat. Zool. p. 209, text-fig. 1 and 2 (1911).

5 ♀♀, Guellet-es-Stel, off *Eliomys quercinus*, April 19, 23, and 25, 1912.

1 ♂, Guellet-es-Stel, off *Meriones shawi*, April 25, 1912.

The occurrence on *Meriones* is no doubt accidental. The natives brought us a small number of young *Eliomys*, some tucked away in their burnouses, and also many specimens of *Meriones*, so that it is quite possible that the *laverani* got on to the *Meriones* after the *Meriones* was caught. Our text-fig. 3 is taken from an Algerian example. We do not notice any difference between European specimens of *laverani* and these Algerian ones, which is evidence in support of Mr. Oldfield Thomas's view that the specimens of *Eliomys quercinus* from the High Plateaux of Algeria do not differ from European examples.

6. *Ceratophyllus maurus* spec. nov. (Pl. VII, fig. 3, 4, and 5).

♂ ♀. Nearest to *C. henleyi* Roths. (1904), from which it is easily distinguished by the modified abdominal segments. Both species are characterised by one or two of the apical bristles of the second hind-tarsal segment extending beyond the fourth segment, the fore-femur bearing several small lateral bristles on the outer surface, and the mid- and hind-coxae having less than ten bristles on the inner surface (apart from the bristles placed at the anterior margin of the coxae). A combination of these three characters occurs only in *henleyi* and *maurus* of all the species of *Ceratophyllus* known to us. The males of *maurus* and *henleyi*, moreover, bear a mane on the thorax and proximal abdominal segments.

Head.—The frons is much more convex in the ♂ than in the ♀, and bears in both sexes a row of three bristles in front of the eye. The upper one of these bristles is placed about on a level with the centre of the eye, and is long; the second bristle is much smaller, while the third is about as large as the first. In the ♂ there are two more bristles above the first eye-bristle, both being thinner and shorter than the second anteocular bristle. The occiput bears one median bristle above the antennal groove, no bristle behind that groove, and a subapical row of five. The ventral bristle of this row is very long and accompanied below by an additional bristle, which is in the ♂ as small as the small hairs placed along the antennal groove, whereas it has in the ♀ the size of the upper subapical bristles. There is a wide gap between the long subapical bristle and the one above it. The rostrum reaches to the trochanter.

Thorax.—The pronotum bears a row of thirteen or fourteen bristles on the two sides together, the ventral bristle being very long and the two dorsal ones slightly more proximal in position than the others, particularly in the ♂, which sex, moreover, has two or three small dorsal bristles in front of the row. The comb contains nineteen to twenty-two spines and an additional small spine on each side. All the spines end in a sharp point. The mesonotum has two rows of bristles and a number of dorsal bristles from the anterior row to the base, as well as a row of minute hairs along the basal edge. In the ♂ the dorsal bristles of the meso- and metanotum, and of the first and second abdominal tergites are semi-erect, and, being more numerous and longer than is usual in *Ceratophylli*, represent a mane (Pl. VII. fig. 4). The small hairs near the anterior edge of the mesopleura are numerous, the ♂ bearing about a dozen or more and the ♀ usually more than eighteen. The mesonotum has about a dozen setiform subapical spines on the inside and the metanotum four or five short, thick apical spines, on the two sides together. The metepimerum has five to seven bristles (2 or 3, 2 or 3, 1).

Abdomen.—The first three or four tergites bear a few short apical spines, and tergites i. to vi. are dorsally minutely dentate. The first tergite has two complete rows of bristles, and in the ♂ some additional dorsal bristles. On the tergites iii. to vii. the anterior row is much reduced in both sexes, but especially so in the ♂. The stigmata are placed some distance in front of the ventral bristle of the posterior row. The ♂ has two antepygial bristles on a rather strongly produced cone, the upper bristle being short and obtuse and the lower one long. In the ♀ there are three antepygial bristles, of which the dorsal one is two-fifths and the ventral one five-sixths the length of the central bristle. The sternites of segments iii. to vi. bear on the two sides together eight or nine bristles in the ♂ and on an average eighteen in the ♀.

Legs.—All the femora have a single subapical ventral bristle on the outside, the fore-femur in addition a number of small hairs on the lateral outer surface, while the mid- and hind-femora bear a row of bristles on the inside. This row contains on the hind-femur six to nine bristles, apart from the subapical ventral one. The hind-tibia has a row of four to six lateral bristles on the inside, and a row of five to seven (inclusive of the apical one) on the outside. One apical bristle of the first hind-tarsal segment reaches to the apex of the second segment, one of the second segment to the apex of the fourth segment and another beyond it. The proximal pair of bristles of the fifth tarsal segment is distinctly moved on to the ventral surface, but is situated proximally to the second pair, not in between it. The relative lengths of the mid- and hind-tarsal segments are as follows:—

Mid-tarsus : ♂ 19, 18, 11, 9, 17 ; ♀ 24, 21, 12, 9, 18.

Hind-tarsus : ♂ 48, 30, 17, 10, 18 ; ♀ 51, 33, 18, 11, 19.

Modified Segments.—♂. The eighth tergite has an irregular row of small bristles from the lower end of the stigma upwards. The widened apical portion of this segment has four or five bristles at the upper edge and four to six on the side. The clasper (Pl. VII. fig. 3) has a straight manubrium (M) with the apex rounded. The process (P) of the clasper is broad and short. The two bristles placed near the insertion of the finger (F) are thinner than the largest bristles of the eighth tergite. The movable process F greatly widens from the base upwards, being broadest beyond the centre. Its proximal edge is almost straight, apart from a central angle, while the distal margin is strongly convex beyond the centre. The oblique upper portion of the distal margin is notched in the middle and bears a moderately large bristle between this notch and the upper proximal angle. Besides this bristle there are only a few very slender ones and some minute hairs on the finger. The ninth sternite (Pl. VII. fig. 3, ix. st.) is of the type found in *C. fasciatus* and allies. The proximal lobe of the exopodite of this segment bears two short strong spiniform bristles.

♀. The seventh sternite varies in outline to a considerable extent, but its apical margin is always evenly incurved, as shown in the figure (Pl. VII. fig. 5); the upper angle is either pointed or more or less rounded off, and sometimes hardly projects as a lobe. The eighth tergite has numerous small bristles above the stigma, and two to four long ones below it accompanied by one or two small ones. On the widened ventral portion of this tergite there are eight bristles along the ventral and apical edge on the outer surface, six or seven long lateral ones, and seven to fifteen small lateral bristles placed proximally to the long ones.

A series of both sexes was obtained, as follows :

17 ♂♂, 20 ♀♀, from Khenchela, off *Meriones shawi*, May 1912.

2 ♂♂, 4 ♀♀, from Guelt-es-Stel, off *Jaculus orientalis*, April 1912.

One of the Khenchela ♀♀ is a very interesting aberration, inasmuch as it throws light on the phylogenetic development of the bristles of the fifth tarsal segment. In the genus *Ceratophyllus* this segment bears five pairs of ventral lateral bristles, of which the first pair is frequently placed on the ventral surface and sometimes even in between the second pair of bristles. Some genera not very distantly related to *Ceratophyllus* were originally chiefly separated from one another on account of the development of the plantar bristles. *Neopsylla*, for instance, was based by Wagner mainly on the fifth hind-tarsal segment bearing only four pairs of lateral bristles. The presence, absence, and position of the first pair of these bristles are therefore considered to be of important taxonomic value. Now, in the specimen of *C. maurus* referred to above, all the tarsi have only four pairs of plantar bristles, as in *Neopsylla*, with the exception of one mid-tarsus which has retained one bristle of the proximal pair lost in the other tarsi.

7. *Ceratophyllus henleyi mauretanicus* subsp. nov. (Pl. VIII. fig. 7 and 9).

♂♀. The specimens from Southern Algeria differ slightly, though perceptibly, from those which we have from Egypt, and which are *C. henleyi henleyi* Roths. (1904). The eighth tergite of the ♂ of *C. h. henleyi* bears six bristles along the upper margin and eight or more on the side. In *C. h. mauretanicus* (Pl. VIII. fig. 7) there are four bristles and a hair at the margin, and four to six at the sides, of which

two or three are small. The seventh abdominal sternite of the ♀ varies in both subspecies individually, but there is an obvious difference in the shape of this segment in the two subspecies. The sinus of the segment is shallow and the lobe above it short and broad in *C. h. henleyi* (Pl. VIII. fig. 8, a and b), while in *C. h. mauretanicus* the sinus is deeper, the upper lobe longer and the lower lobe (in side-view) also longer and much more pointed (Pl. VIII. fig. 9, c and d).

The modified segments do not seem to present any other differences. We add that in our original figure of *henleyi* (*Entom.* 1904, pl. 2), the third bristle of the "finger" counted from the apex is rather too long.

We have of *mauretanicus* ;

1 ♂, 1 ♀, from Khenchela, off *Dipodillus campestris*, May 8 and 9, 1912.

1 ♂, 1 ♀, from Biskra, off *Meriones shawi*, March 1908, collected by J. Steinbach.

8. *Ceratophyllus farreni meridionalis* subsp. nov. (Pl. IX. fig. 10).

♀. The three Algerian specimens, all females, which we have of *C. farreni* differ from the British examples in the shape of the seventh abdominal sternite. The sinus of this sternite is less deep and also narrower than in *C. farreni farreni*, and the lobes broader. In British specimens the sinus extends more or less close to the row of long bristles, one of the bristles often standing at the edge of the sinus, while in *C. farreni meridionalis* the distance of the apex of the sinus from the nearest bristle equals at least half the depth of the sinus (Pl. IX. fig. 10). We figure for comparison a specimen from Scotland (Pl. IX. fig. 11).

3 ♀ ♀, from Guellet-es-Stel, taken from nests of *Chelidon urbica meridionalis*, April 24 and 25, 1912.

This is the only bird-flea which we met with. The chief interest attaching to *C. f. meridionalis* lies in the fact that its difference from the northern form confirms the subspecific distinctness of the Algerian *Chelidon urbica*.

9. *Ctenophthalmus russulae* spec. nov. (Pl. X. fig. 12 and 13).

♂ ♀. Near to *Ct. ansorgei* Roths. (1907), *triodontus* Roths. (1907), and *engis* Roths. (1907), all from tropical Africa, but at once distinguished from all three by the occiput bearing in the middle a single bristle placed above the antennal groove instead of a row of bristles.

Ct. ansorgei was originally described from two ♀ ♀*. We now possess the ♂ from the same place and host, and the genitalia of this sex prove that we were right in placing *ansorgei* near *Ct. caucasica* Tsch. (1880). All these species have three genal spines, the eye vestigial, the posterior apical bristle of the labial palpus long and strongly curved forward, the subapical ventral bristle of the hind-femur short and spiniform, and the fifth tarsal segment provided with three lateral ventral pairs of bristles, with an additional pair on the ventral surface in between the first pair.

Head.—The frons bears an anterior row of five bristles and a posterior row of three long ones. The vestigial eye is less pigmented than in *C. ansorgei*. The first spine of the genal comb is sharply pointed. The occiput bears a row of four bristles

* In *Nov. Zool.* 1907, p. 330 and 331 the figures of *Ct. ansorgei* and *Ct. triodontus* have been transposed: fig. 2 is *triodontus* and fig. 4 *ansorgei*, and not vice versa. The same has happened with the outlines of these figures reproduced on Plate 3 of the *Ent. Mo. Mag.* 1907.

running from the vertical part of the antennal groove across the pale lateral (sensory) dot towards the posterior dorsal pale dot. The two anterior bristles of this row corresponded to the anterior row of *ansorgei*, and the two posterior ones to the upper bristles of the second row found in that species. Above the antennal groove there is one long median bristle. The subapical row contains four bristles on each side, the interspace between the first and second being large.

Thorax.—The prothorax bears a row of nine long bristles on the two sides together, the row of the meso- and metathorax containing nine or ten bristles. The prothoracic comb consists of fifteen to seventeen spines. The metepimerum bears usually five bristles (2, 3), there being rarely an additional, small bristle present in the anterior row.

Abdomen.—The bristles of the abdomen are a little less numerous than in *ansorgei*, the postmedian row of the central tergites containing usually twelve, rarely thirteen long bristles. The difference in the number of bristles is especially noticeable on the modified segments viii. to x. in the ♂ and vii. to x. in the ♀.

Modified Segments.—♂. The eighth tergite bears on each side two or three small bristles above the stigma. The eighth sternite has a row of four or five long bristles, and proximally to the row three to five smaller bristles. The dorsal outline of the sensory plate (pygidium) is almost straight, the pygidium not being convex in this sex. The anal tergite is very little longer than the pygidium and bears, on the two sides together, seventeen small bristles besides two longer apical ones. The clasper is distally divided by a narrow rounded sinus into two short rounded lobes (Pl. X. fig. 12), of which the upper one (P¹) bears two very long and three much shorter and thinner bristles. Below the lower process (P²) there is one long bristle at the edge of the clasper. The manubrium (M) is narrowed quite gradually to a sharp point and evenly curved, the point being directed upwards. The general appearance and structure of the movable finger (F) are essentially as in *Ct. caucasica* (and *ansorgei*), but the finger is much broader and shorter than in *caucasica*. It bears about a dozen short bristles at the dorsal edge, three at the apex and four at the ventral margin. The ninth sternite (ix. st.) has a rather slender vertical arm, whose apex, however, is much widened, as shown in the figure. The horizontal arm is boat-shaped in a lateral aspect and bears many small bristles in the distal half.—♀. The seventh sternite (Pl. X. fig. 13, vii. st.) is divided by a narrow sinus into a very broad truncate-emarginate upper lobe and a small lower one, and bears a row of four or five bristles and proximally to it three or four smaller ones. These bristles vary in size, but the two below the sinus always remain large. The eighth tergite has no bristles above and below the stigma, in which character the present species agrees with *tridontus* and *engis*, while *ansorgei* and *caucasica* have some small bristles above the stigma. The ventral portion of the eighth tergite bears a ventral row of five bristles, of which the apical one is stout and short and the third the longest. Above this row there are three or four more bristles, the proximal ones being small and the distal one large, the latter being placed above the second of the ventral row. On the inner surface there is a cluster of four or five small bristles before the apex. The apical angle of this tergite is rounded off. The pygidium is convex as in the ♀ of the allied species. The anal tergite is distinguished by bearing a row of three lateral bristles proximally to the stylet, the above-mentioned African species as well as *caucasica* having only the ventral bristle of this row. The stylet is conical and about thrice as long as it is broad at the base. The anal

sternite bears four bristles on each side, these bristles being slenderer than in the species named above, particularly the first and second bristles.

Length: ♂ 8—2 mm., ♀ 2—2.4 mm.

We obtained a series of both sexes at Alger in March, April, and May 1912, also some ♀♀ in May 1908—altogether 18 ♂♂ and 27 ♀♀. Most of the specimens were found on *Crocidura russula*, and a few on *Mus algirus* and *Apodemus sylvaticus*, and one on *Gerbillus campestris*. The occurrence on the last three hosts is doubtless accidental. Although we obtained a number of *Crocidura russula* at Hammam Rirha, as well as many *M. algirus* and *A. sylvaticus*, the present species of flea was conspicuous by its absence.

Rhadinopsylla gen. nov.

♂♀. Frons without tubercle, or this quite external, not placed in a groove. Antennal groove completely closed above, there being no sulcus across the vertex and the internal incassation only being vestigial. A genal comb of five spines. Eye barely traceable. Labial palpi with five segments, the last segment posteriorly with a curved apical bristle as in true *Ctenophthalmus*. Pronotum with comb. Episternum of metathorax prolonged downwards, hind edge of sternum shortened; epimerum of metathorax narrower and dorsally more rounded than in *Ctenophthalmus*, very densely striated above the ventral margin; its stigma much more frontal than in the allied forms, being placed nearly half-way between the oblique upper edge and the anterior edge of the metepimerum. Metanotum without the short strong apical spines found on the proximal abdominal tergites, but with minute teeth. No antepygial bristles in the ♂, but two on each side in ♀, both being long. Pygidium strongly convex in both sexes. Legs slender, particularly the femora. Basal internal rod of mid-coxa broad, bearing a mesial earina and therefore somewhat recalling a shoulder-blade, the corresponding rod of the hind-coxa narrow and quite short. Hind-coxa with a patch of short spiniform bristles on the inner surface. The fifth segment of all the tarsi with four pairs of lateral bristles as in the hind-tarsus of true *Neopsylla*.

Genotype: *R. masculana* spec. nov.

The genus is closely allied to both *Neopsylla* Wagner (1902) and *Ctenophthalmus* Kolen. (1856), but distinguished by the characters mentioned above. Besides the type two other species belong here: *pentacanthus* Roths. (1897) and *isacanthus* Roths. (1907). They agree closely with *masculana*, but have the frons not produced into a sharp angle, whereas they bear a small frontal tubercle, which is absent from *masculana*.

10. *Rhadinopsylla masculana* spec. nov. (Pl. XI. fig. 14, 15 and 16).

Head.—We figure the head of the ♀ (Pl. XI. fig. 14). That of the ♂ differs in the frons being more convex between antennal groove and frontal corner, and in the occiput being longer than in the ♀. The frontal part of the head bears in both sexes an anterior row of six bristles as shown in the figure, and between this row and the comb two longer bristles. The first spine of the comb is the smallest, the last (or most dorsal) the broadest, and the third and fourth the longest. The antennal groove extends farther upwards in the ♂ than in the ♀; the optical dorsal outline of the head is slightly incrassate above the antennal groove, but not interrupted. The occiput has three rows of bristles. There is no row of short

bristles along the antennal groove. The eye is traceable at the base of the uppermost spine of the comb. The maxillary palpus is as long as the rostrum or even a little longer, both reaching to the trochanter or close to the apex of the fore-coxa. The apical segment of the labial palpus is much shorter than the preceding one, being scarcely twice as long as broad. The bristle placed at the posterior corner of this segment is long and strongly curved. The first segment of the antenna bears only a few short hairs, and the hairs of the second segment are all short.

Thorax.—The comb of the pronotum contains thirteen or fourteen spines, the ventral ones being much shorter than the others and also placed farther away from the basal margin, so that the bases of the spines form a curved oblique line. The most ventral spine is placed at least as far from the lower edge of the pronotum as do the dorsal spines from the base of the pronotum. There is a single row of eight long bristles on the two sides of the pronotum together, the ventral bristle being nearer the base of the pronotum and the dorsal bristles nearer the comb. The dorsal spines of the comb are almost twice as long as their distance from the base of the pronotum. The mesonotum is as long as the pronotum inclusive of comb, and a very little longer than the metanotum, and bears a postmedian row of ten long bristles on the two sides together. The surface between this row and the base is covered with numerous short bristles, with the exception of the ventral portion of the mesonotum. On the inner surface near the apex there is a dorsal bristle-like spine on each side. The mesopleura bear four long bristles and sometimes an additional small one. The metanotum has dorsally at the apical edge some minute teeth, but no spines like the abdominal tergites, and bears two rows of bristles, the anterior row containing nine to twelve smaller bristles, and the posterior row eight or nine long ones. The metanotum and metepisternum are externally almost entirely continuous. The portion corresponding to the episternum is so enlarged ventrad that it is longer in a dorsoventral direction than its distance from the insertion of the coxa. It bears one long and two smaller bristles, while the metasternum has one long bristle and one short one. The metepimerum has the upper angle rounded off, the proximal edge moderately rounded, and the distal edge more strongly so. It bears an antemedian row of three bristles and farther upwards a postmedian row of three longer ones, the stigma being placed between the two dorsal bristles of the second row. This stigma is larger than the abdominal ones. Near the ventral margin of the metepimerum, from near the insertion of the coxa obliquely backwards there is a space which bears, instead of the ordinary undulate or angulate ridges characterising the exoskeleton of Siphonaptera, numerous regular parallel ridges, some of which are continuous with the ordinary ridges of the rest of the metepimerum.

Abdomen.—Tergites i. to vi. bear short but strongly chitinated apical spines as follows on the two sides together: in ♂ 6, 6, 6, 4, 2, 2, and in ♀ 6, 6, 4, 2, 2, 2; i. to vii. have two rows of bristles, the second row contained on the two sides together 8, 12, 12, 12, 12, 10. The stigmata are placed between the two lower bristles of the second row; they are elongate and but little broader than the groove of insertion of the lowest bristle. The ♀ bears two long antepygial bristles on a common truncate prominence. The edge of the segment is produced dorsally, *i.e.* in between the antepygial pairs of bristles, and sinuate below these bristles, the edge being slightly convex below the sinus and then oblique and almost straight. In the ♂ the seventh tergite resembles the preceding ones, the row of long

bristles being situated in the centre of the segment and there being no antepygidial bristles. The bristles of the sternites are long, the numbers being as follows on the two sides together: in ♂ 2, 6, 8, 8, 8, 7; and in ♀ 2, 9, 11, 10, 10, sternites iii. to vi. of the ♀ bearing on each side one bristle in front of the row, and sternite vii. having altogether seventeen bristles. The pygidium is strongly convex, projecting backwards.

Legs.—The subapical sinus at the hind-side of the mid-coxa is semicircular, the angle above it being but slightly rounded off and the hindmargin of the mid-coxa almost straight; the apical lobe of the mid-coxa is large, and there are two bristles on its base at some distance from the sinus. The hind-coxa bears a patch of about ten short spiniform bristles on the inside at the apical third, those bristles of this patch which are nearest the anterior edge of the coxa being longer and thinner, and those placed between the patch and the apex of the coxa being normal in shape. The posterior subapical sinus of the hind-coxa is shallower than in the mid-coxa, and the apical lobe longer. This lobe bears three long bristles. The femora are slender, the proportional length and width of the hind-femur being 21 and 8 respectively, and bear one bristle on the inner lateral surface towards the base. There are two subapical ventral bristles on the outside of the hind-femur and one on the inside, all long and slender. The tibiae have six dorsal notches inclusive of the apical one, each bearing a pair of divergent bristles, there being sometimes an additional solitary dorsal bristle between the fourth and fifth pairs of the hind-tibia. A row of six lateral bristles on the outer surface corresponds with the dorsal notches. The longest ventral apical bristle of the mid-tibia and the longest dorsal apical bristle of the hind-tibia reach far beyond the apex of the first tarsal segment. The bristles of the tibiae and those of the hind-tarsus are very strong. The longest one of the first hind-tarsal segment extends beyond the apex of the second segment and the corresponding bristle of the second reaches a little beyond the fourth. The mid-tarsi of the ♂ are broken. The tarsal segments measure:

♂ hind-tarsus 33, 31, 13, 10, 19.

♀ mid-tarsus 18, 16, 9, 7, 18; hind-tarsus 40, 24, 14, 11, 20.

The fourth hind-tarsal segment is twice as long as it is broad. The four ventral pairs of bristles of the fifth segment are quite lateral, the first pair not being moved on to the ventral surface.

Modified segments.—♂. The eighth tergite bears no bristles. The cavity of the stigma is large, nearly horizontal, and almost gradually narrows inwards. The eighth sternite is large and has a transverse row of eight bristles on the two sides together. The clasper is longer than it is broad, with the dorsal and ventral margins almost parallel (Pl. XI. fig. 12), the distal margin slanting upwards, the lower angle quite effaced and the upper one extended to near the apex of the "finger" (Pl. XI. fig. 15, P). The clasper bears one moderately strong bristle below the insertion of the finger, a small and thin one above the insertion, and several other thin ones at and near the apex of the process P. Moreover, there are several larger bristles at the dorsal margin, one of which is particularly strong and long. The manubrium (M) is broad proximally and narrow distally, its ventral margin being moderately convex. The finger (Pl. XI. fig. 15, F) is narrow, evenly curved, somewhat tapering, with the distal side convex. The bristles are all thin and short, the one placed in the centre of the distal surface being the longest. The ninth sternite is boomerang-shaped; the ventral, horizontal portion is particularly

broad proximally and gradually tapers to a point distally, the dorsal margin being slightly incurved and the ventral margin gradually rounded. This sternite bears numerous small bristles, as shown in the figure. The anal segment is separated from the pygidium by a distinct suture, the tergite being convex in the centre and bearing here a number of long bristles.

♀. The modified segments of this sex are very interesting. The seventh sternite bears eight or nine bristles on each side, and is divided by a deep and very narrow sinus into two lobes (Pl. XI. fig. 16). The upper lobe, which is incomplete in our specimens, is strongly chitinated, with the ridges unusually prominent. It is undoubtedly rounded at the apex when in a perfect condition. The lower lobe is much narrower and tapers to a point (lateral aspect). The eighth tergite has no bristles above the stigma, but bears two or three below it, the lower one of them being long. The ventral lateral portion is divided by a narrow apical sinus, much as in *Stenoponia tripectinata* Tirab. (1902), and bears above this sinus two long bristles on the outer surface and four shorter ones on the inside. The outer surface, moreover, has a subventral row of five long bristles and above this row five more bristles. The anal tergite is not divided by a suture from the very strongly convex pygidium, but is also convex in the centre as in the ♂ and bears here long bristles. The stylet is slender, being four times as long as it is broad and about equal in length to the third hind-tarsal segment. The receptaculum seminis (Pl. XI. fig. 16 rec.) is characterised by the head not being much wider than the beginning of the tail, and the apex of the tail being strongly chitinated and separated from the rest of the tail by a constriction.

Length (mounted specimens): ♂ 1.7 mm., ♀ 2.2 mm.

1 ♂ and 2 ♀ ♀, from Khenchela, off *Meriones shawi*, early May 1912.

1 ♀, from Guelt-es-Stel, off *Meriones shawi*, late April 1912.

11. *Typhloceras poppei* Wagn. (1902).

T. p. Wagner, *Hor. Soc. Ent. Ross.* xxxvi. p. 154 (1902) (Vegesack, near Bremen).

The species, which appears to be widely distributed in the western portion of the Palaearctic Region, does not seem to vary geographically. The specimens from Algeria agree with those we have from England and Germany.

A noteworthy peculiarity of this interesting species is the position of the antepygial bristles. These are placed on elevated and strongly chitinated sockets which are placed some distance from the apical edge of the segment, as in *Pulex* and allied genera. In *Ctenophthalmus*, *Ceratophyllus*, etc., in fact, in the majority of Siphonaptera, the seventh tergite is sinuate posteriorly to the antepygial bristles, so that their sockets are placed at the hind-margin of the segment.

1 ♀ from Alger, taken off *Mus algerius* on April 1, 1912.

1 ♀ " " " " *Apodemus sylvaticus* on March 21, 1912.

12. *Leptopsylla algira* spec. nov. (Pl. XII. fig. 17, 18, 19).

♂ ♀. A species with three genal spines, as in *L. taschenbergi* Wagn. (1898), from Europe, and *L. aethiopicus* Roths. (1908), from Tropical Africa, but differs in the smaller number of teeth in the pronotal comb and the modified abdominal segments of both sexes.

The upper spine of the genal comb (Pl. XII. fig. 18) covers the genal process to a greater extent than in *L. aethiopicus*. The pronotal comb contains twenty-two spines on the two sides together, besides a small ventral spine on each side. The proportional lengths of the first and second segments of the tarsi are appreciably different in *L. aethiopicus* and *L. algira*, the first segment being longer in the former species than in the latter. The measurements of the mid- and hind-tarsi are in *L. algira*:

Mid-tarsus: ♂, 18, 15, 11, 8, 14; ♀, 17, 13, 10, 7, 13.

Hind-tarsus: ♂, 39, 24, 16, 9, 15; ♀, 37, 21, 15, 8, 14.

Modified Segments.—♂. The movable process (Pl. XII. fig. 17, F) reaches to the apex of the elasper in the species mentioned above as well as in the new one, and is more or less convex on the distal side and concave on the proximal side, being of almost even width in *taschenbergi* with the apical portion slightly tapering (according to Wagner's figure), whereas it is broadest beyond the centre in *algira*, and almost club-shaped in *aethiopicus*. It bears five bristles on the distal side, of which the last but one is the longest, the last the second longest, and the other three are thin and nearly equal in length. The clasper is produced into a long process (P), which is slightly curved towards the "finger" (F) and somewhat widened before the apex. This process bears a long bristle at the distal margin beyond two-thirds of the way from the insertion of the finger to the apex of the process, a small bristle being placed farther apically and a minute hair on the dorsal side. The manubrium (M) is shorter than the clasper in *algira*, while it is longer than the clasper in *aethiopicus* as well as in *taschenbergi*. The distal portion of the ninth sternite is very complicated both in *algira* and *aethiopicus* (and presumably also in *taschenbergi*) and only differs in the detail in the two species, this sternite in *algira* bearing fewer bristles and being broader at the apex. The eighth sternite (Pl. XII. fig. 17, viii. st.) is triangular in a lateral view in *algira* and has five bristles, whereas in *aethiopicus* it is conical with the tip rounded and bears a larger number of bristles at and near the apex.

♀. This sex is at once distinguished from the ♀ of *aethiopicus* by the seventh sternite (Pl. XII. fig. 19, vii. st.) being divided by a deep sinus into a narrow and pointed upper lobe and a broader and longer lower one. The bristles on the eighth tergite are fewer in number in *algira* than in *aethiopicus*, the former bearing about a dozen bristles on the widened ventral portion of the segment, while *aethiopicus* has sixteen or more. The stylet is somewhat longer in *algira* than in *aethiopicus*, the head of the receptaculum seminis (Pl. XII. fig. 19, r.s.) being also longer and narrower than in *aethiopicus*.

The antepygidial bristles of *algira* and *aethiopicus* (and perhaps *taschenbergi*) are remarkable for their arrangement. The ♂ bears on each side three and the ♀ four, and these bristles are divided into two sets separated by a sinus of the hind-margin of the seventh tergite, there being two bristles above the sinus and one below it in the ♂, and two above and two below it in the ♀. In *L. musculi*, *sobrinus*, *pectiniceps*, etc., the sockets of the antepygidial bristles of each side are contiguous, there being no interspace within the cluster.

L. algira was plentiful on *Arvicanthus barbarus* at Alger and Hammam Rirha together with *Ceratophyllus barbarus*, both fleas being found on the same individuals of the host as well as in the nest. We also found a few specimens on *Crocidura russula* and *Apodemus sylvaticus*, which are doubtless accidental hosts.

13. *Stenoponia tripectinata* Tirab. (1902).

Hystriropsychylla tripectinata Tiraboschi, *Boll. Soc. Zool. Ital.* xi, p. 169, plate (1902) (Italy).

We proposed *Stenoponia* for *tripectinata* and *coelestis* in *Proc. Zool. Soc. Lond.*, p. 391 (1911). The chief distinctions are the four-segmented labial palpi and the presence of one receptaculum seminis instead of two as in *Hystriropsychylla*.

S. tripectinata is a Mediterranean species known from Italy, Asia Minor and the Azores. We met with it only on the Hants Plateaux.

3 ♂♂, 2 ♀♀ from Guelt-es-Stel, off *Meriones shawi*, April 21 and 23, 1912.

1 ♂, 2 ♀♀ from Khenchela, off *Meriones shawi*, May 10, 1912.

9 ♂♂, 4 ♀♀ from Khenchela, off *Mus algirus*, May 8, 1912.

14. *Ischnopsyllus unipectinata* Tasch. (1880).

Typhlopsylla unipectinata Taschenberg, *Die Flöhe* p. 91 (1880) (Switzerland, off *Rhinolophus hipposideros*).

1 ♂, 1 ♀ from Guelt-es-Stel, off *Rhinolophus ferrum-equinum*, April 17, 1912.

Only the pronotal comb is developed in this species, but there are some short stout spines at the apices of the metanotum and the first three abdominal tergites which are presumably remnants of four more combs. From the presence of these vestigial combs we may conclude that species exist or have existed with these combs fully developed. *R. unipectinata* agrees in all essentials best with *Ischnopsyllus*, apart from the male genitalia, which are of a different type.

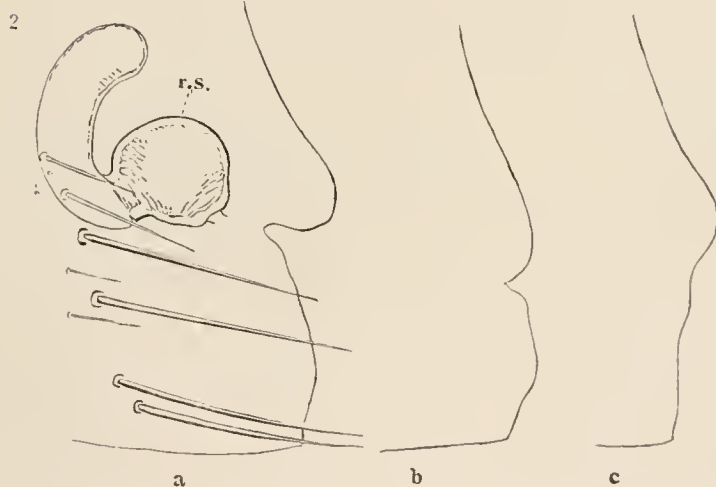
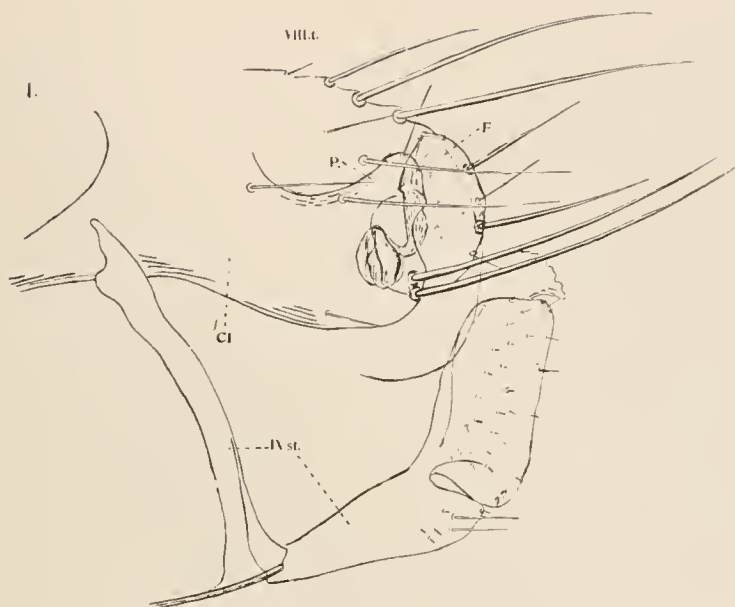


FIG. 1.—Organs of copulation of *Ceratophyllus barbarus* ♂. viii. t. = eighth abdominal tergite, ix. st. = ninth sternite, Cl = clasper, P = process of clasper, F = movable process,
 FIG. 2.—Seventh abdominal sternite of three specimens (a, b, c) of *Ceratophyllus barbarus* ♀. r.s. = receptaculum seminis.

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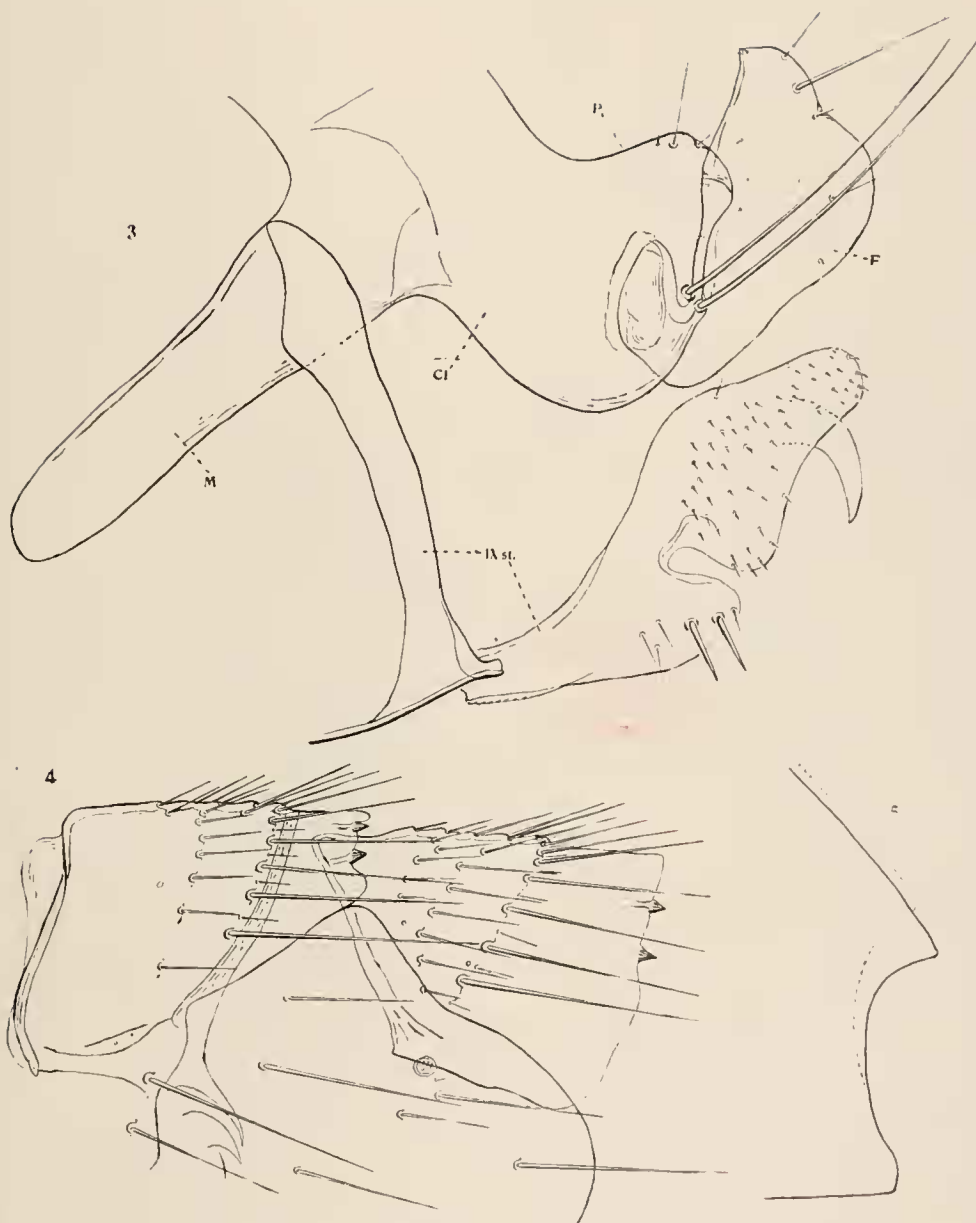
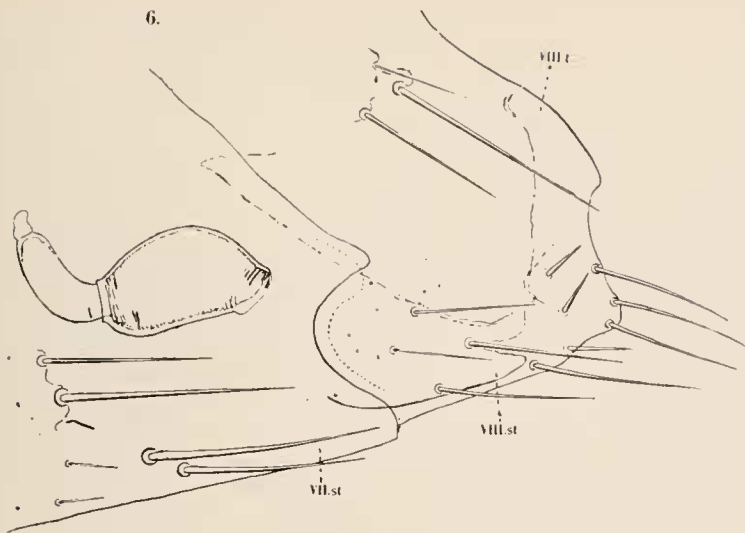


FIG. 3.—Organs of copulation of *Ceratophyllus maurus* ♂. M = manubrium.

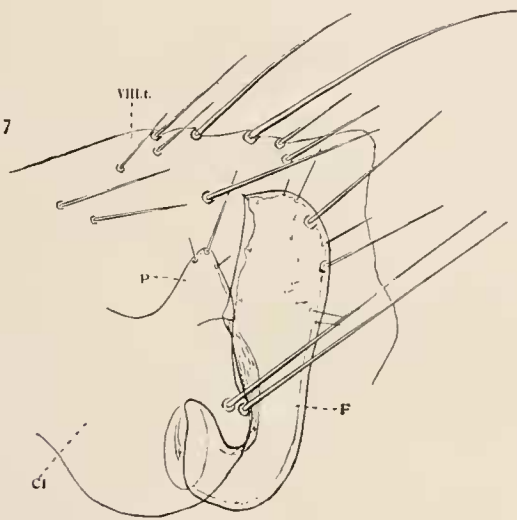
FIG. 4.—Meso- and metanotum of the same.

FIG. 5.—Seventh abdominal sternite of *Ceratophyllus maurus* ♀.

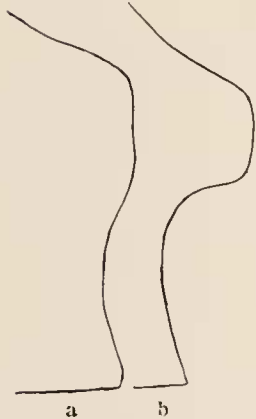
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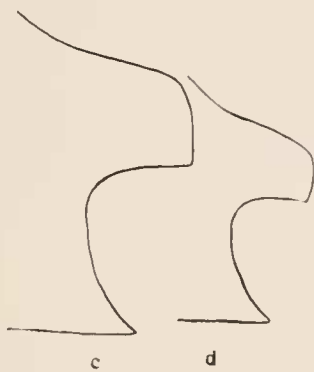


FIG. 6.—Posterior abdominal segments of *Ceratophyllus liversani* ♂.
FIG. 7.—Organs of copulation of *Ceratophyllus henleji* mauritanicus ♂.
FIG. 8.—Seventh abdominal sternite of *C. h. henleji* ♀.
FIG. 9.— " " " " *C. h. mauritanicus* ♀.

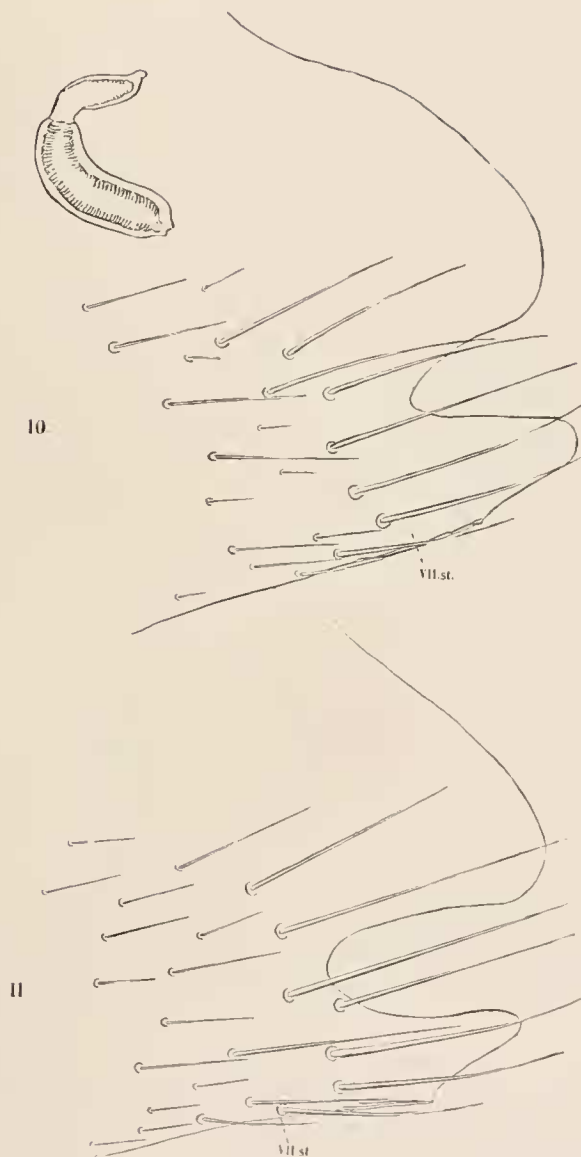


FIG. 10.—Seventh abdominal sternite of *Ceratophyllus farreni meridionalis* ♀.

FIG. 11.— „ „ „ „ *C. f. farreni* ♀.

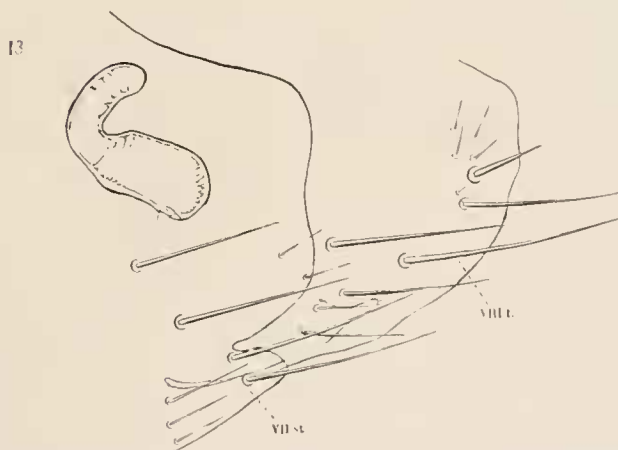
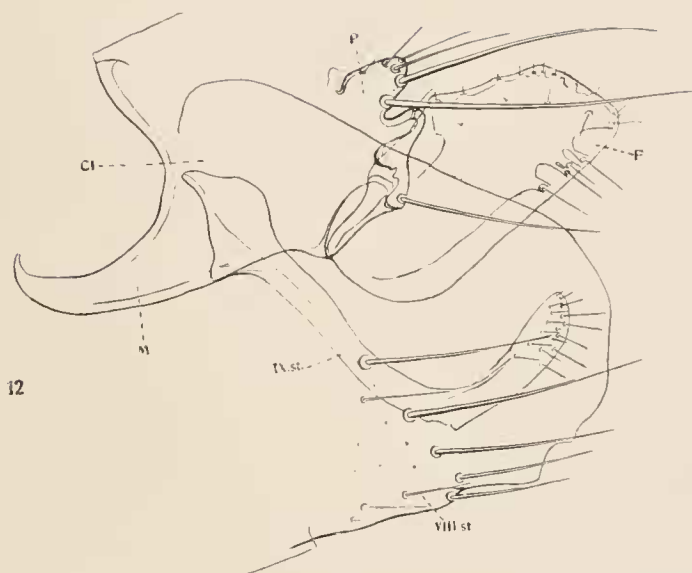


FIG. 12. Organs of copulation of *Ctenophthalmus russulae* ♂. Cl = clasper, M = manubrium, P = process of clasper, F = movable process, viii. st. and ix. st. = eighth and ninth abdominal sternites.

FIG. 13. Seventh sternite (vii. st.) and ventral portion of eighth abdominal tergite (viii. t.) of *Ctenophthalmus russulae* ♀.

K. J. del.

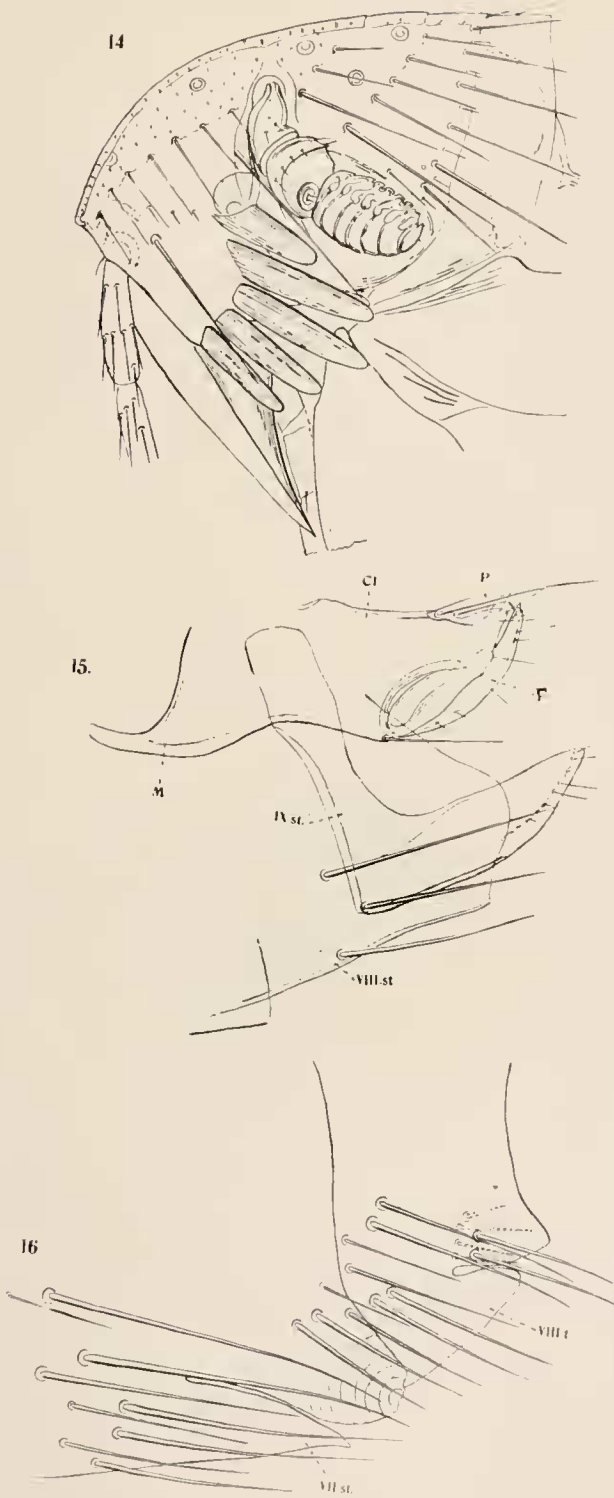


FIG. 14.—Head of *Rhadinopsylla masculana* ♂. Cl = clasper, M = manubrium, P = process of clasper, F = movable process, viii. st. and ix. st. = eighth and ninth abdominal sternites.
FIG. 15.—Organs of copulation of *Rhadinopsylla masculana* ♀.
FIG. 16.—Seventh abdominal sternite (vii. st.) and ventral portion of eighth tergite (viii. t.) of *Rhadinopsylla masculana* ♀.

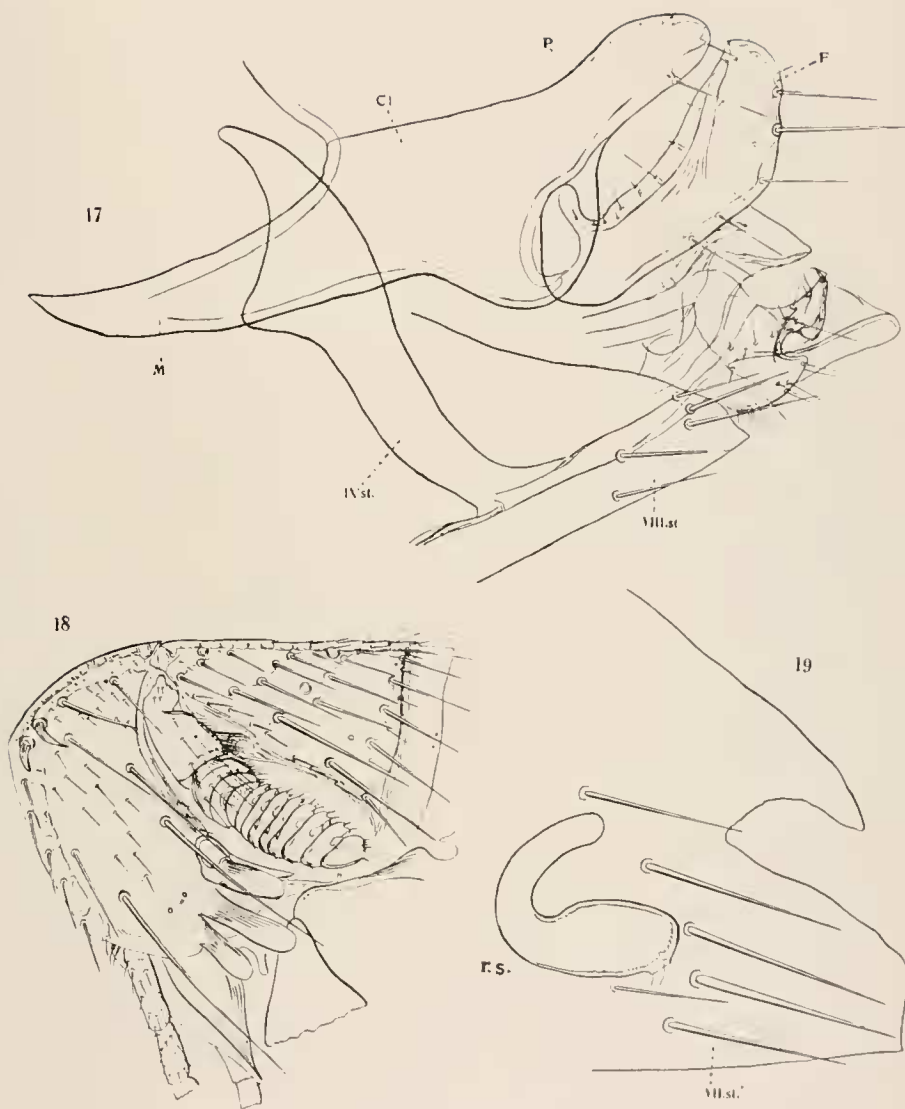


FIG. 17.—Organs of copulation of *Leptopsylla algira* ♂. Cl = clasper, M = manubrium, P = process of clasper, F = movable process ("finger"), viii.st. and ix.st. = eighth and ninth abdominal sternites.

FIG. 18.—Head of *Leptopsylla algira* ♂.

FIG. 19.—Seventh abdominal sternite of *Leptopsylla algira* ♀. r.s. = receptaculum seminis.

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